

U.S. Patent Appln. S.N. 09/914,305
AMENDMENT AFTER FINAL REJECTION

PATENT

REMARKS

This Amendment cancels claims 16-19 and 24, and rewrites claim 1. A version showing changes made is attached as an Appendix. Claims 1-7, 9-15, 20, 21, 23 and 25-27 are pending.

Entry of this Amendment is earnestly requested, as it is believed (1) to place the application in condition for allowance, (2) not to raise any new issue or require further search, (3) to be directly responsive to the Final Rejection, and (4) to place the application in even better form for appeal, should such appeal be necessary.

Examiner Lee is thanked for indicating the allowability of claims 20, 21, 23 and 27. It is believed this Amendment places the entire application in condition for allowance for the reasons which follow.

This Amendment overcomes the objection to claim 1, which has been rewritten in accordance with the Examiner's helpful suggestion. Reconsideration and withdrawal of the objection to claim 1 are earnestly requested.

The 35 U.S.C. § 112, first paragraph, rejection of claim 19 is rendered moot by the cancellation of that claim. Reconsideration and

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withdrawal of the non-enablement rejection of claim 19 are earnestly requested.

This Amendment also overcomes the 35 U.S.C. § 112, second paragraph, rejection of claim 1, which has been rewritten to employ proper Markush terminology. Reconsideration and withdrawal of the indefiniteness rejection of claim 1 are earnestly requested.

The 35 U.S.C. § 112, second paragraph, rejection of claims 1, 16, 18-20, 23 and 25-27 is respectfully traversed. Claims 18 and 19 have been canceled. One of ordinary skill in the art would understand the metes and bounds of the remaining claims, both with respect to "optionally" and with respect to the specified types of heteroatoms.

1. "Optionally"

The use of the term "optionally" has been held definite by the Board of Patent Appeals and Interferences:

However, the use of the term "optionally", as employed in claim 1, is akin to expressions such as "up to" and "0 to ...". Such alternative language does not normally render claims indefinite under the second paragraph of 35 U.S.C. § 112.

Ex parte Cordova, 10 USPQ2d 1949 (Bd. App. & Interf. 1988).

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2. "Heteroatoms belonging to Groups 13..."

Similarly, one of ordinary skill in the art would understand "heteroatoms belonging to Groups 13 or 15-17 of the Periodic Table of the Elements" to mean any element from the specified Groups. One of ordinary skill in the art would also understand that the heteroatom must be bound to a carbon atom because the R¹⁻¹⁰ groups in the claims contains only carbon atoms and hydrogen atoms.

Reconsideration and withdrawal of the indefiniteness rejection of claims 1, 16, 18-20, 23 and 25-27 are earnestly requested.

The 35 U.S.C. § 102(b) rejection of claims 1-7, 9-12, 16, 17 and 24-26 over PCT Patent Publication WO 98/22486 to Ewen et al. is respectfully traversed. Claim 16, 17 and 24 have been canceled. Process claims 1-7 and 9-12 are directed to the preparation of ethylene polymers using a catalyst system formed by contacting a metallocene compound of formula (I) with a compound selected from a Markush group consisting of an alumoxane and a compound capable of forming an alkyl metallocene cation. The inventors have discovered that the use of a specified halogen-containing metallocene catalyst permits production of high molecular weight polyethylene in high yield.

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Ewen et al. fails to anticipate the claimed process for polymerizing ethylene. Although Ewen et al. broadly discloses the utility of its process for polymerizing homopolymers and copolymers of vinyl monomers having from 2 to 20 carbon atoms (page 13, lines 6-12), only Example 7 is directed to ethylene polymerization, and the metallocene catalyst utilized therein - isopropylidene [cyclopentadienyl-(7-cyclopentadithiophene)] zirconium dichloride - does not come within the scope of the claimed process.

A claim is anticipated only if each and every element set forth in the claim is found, either expressly or inherently described, in a single prior art reference, Verdegaal Bros. v. Union Oil of California, 814 F.2d 628, 6312, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). In this case, Ewen et al. fails to disclose the polymerization of ethylene using a catalyst system prepared by contacting a metallocene of formula I with at least one member selected from the group consisting of an alumoxane and a compound of formula D^+E^- , wherein D^+ is a Brønsted acid, which gives a proton and reacts irreversibly with a substituent X of the metallocene of formula (I) and E^- is a compatible anion, which stabilizes the active catalytic species originating from the reaction of the two compounds, and which is removed by an olefinic monomer.

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Claims 25 and 26 are directed to a metallocene compound of formula (I) and its corresponding ligand of formula (II). Both claims expressly disclaim compounds disclosed by Ewen et al. Accordingly, it is believed that these claims do not read on the reference.

Reconsideration and withdrawal of the anticipation rejection of claims 1-7, 9-12, 16, 17 and 24-26 over Ewen et al. are earnestly requested.

The claimed process for polymerizing ethylene is patentable over Ewen et al. because use of the metallocene catalysts recited by the claimed process provides surprising results which one of ordinary skill in the art would not expect in view of Ewen et al. More particularly, the catalysts employed in the claimed process exhibit unexpectedly high activity, and produce ethylene having a much higher molecular weight than would be expected by one of ordinary skill in the art.

These surprising results are demonstrated by comparison of the data in Table 1 of Ewen et al., 120 J. Am. Chem. Soc. 10786 (1998).¹ The relevant polymerization data for isopropylidene

¹The Ewen et al. article is used for comparison, rather than the Ewen et al. patent application, because the reaction conditions used are substantially the same. In contrast, the data in the Ewen et al. application cannot be compared.

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(cyclopentadienyl)-(7-cyclopentadithiophene) zirconium dichloride ("cp"), which is the sole metallocene catalyst used to polymerize ethylene in the Ewen et al. application, and isopropylidene(3-*t*-butyl-cyclopentadienyl)-(7-cyclopentadithiophene) zirconium dichloride ("ter-cp"), which comes within the formula for the permissible metallocene catalysts of the claimed ethylene polymerization process, are set forth below:

Entry	Catalyst	Activity	Mw of Polypropylene
1	Ter-Cp	13	91
3	Cp	14	98

From this data it is clear that the ter-cp metallocene catalyst is less active than the cp metallocene catalyst, and moreover, that the ter-cp metallocene catalyst produces polypropylene having a lower molecular weight than the cp metallocene catalyst. Thus, one of ordinary skill in the art would expect that a similar relationship would result if these two catalysts were used to polymerize ethylene.

The inventors have surprisingly found that ter-cp exhibits a much higher activity when used in ethylene polymerization than cp, as

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polyethylene of higher molecular weight than suggested by Ewen et al. when used to polymerize propylene.

Reconsideration and withdrawal of the obviousness rejection of claims 13-15 over Ewen et al. in view of Santi et al. are earnestly requested.

The 35 U.S.C. § 103(a) rejection of claim 18 over Kraak et al., 24 Tetrahedron 3381 (1968) is rendered moot by the cancellation of that claim. Reconsideration and withdrawal of the obviousness rejection of claim 18 are earnestly requested.

The 35 U.S.C. § 103(a) rejection of claim 19 over Kraak et al. in view of Elschenbroich et al., Organometallics 19-29 (1989) is rendered moot by the cancellation of that claim. Reconsideration and withdrawal of the obviousness rejection of claim 19 are earnestly requested.

It is believed this application is in condition for allowance. Reconsideration and withdrawal of all objections and rejections of claims 1-7, 9-21 and 23-27, and issuance of a Notice of Allowance directed to claims 1-7, 9-15, 20, 21, 23 and 25-27, are earnestly requested. The Examiner is requested to telephone the undersigned should he believe any further action is required for allowance.

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A Petition and fee for a one month Extension of Time is attached. It is not believed that any additional fee is required for entry and consideration of this Amendment. Nevertheless, the Commissioner is hereby authorized to charge our Deposit Account 50-1258 in the amount of any such required fee.

Respectfully submitted,

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Enclosures:
Appendix
Petition for Extension of Time

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APPENDIX

Version Showing Changes Made

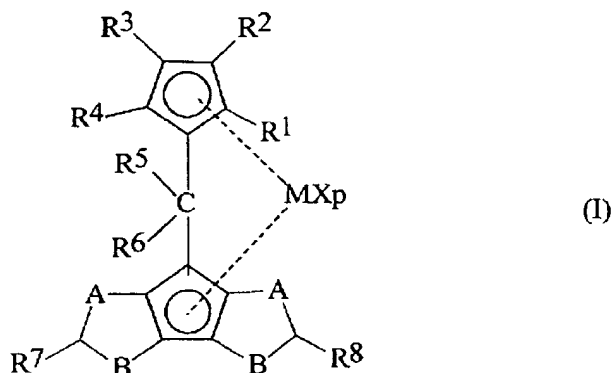
IN THE CLAIMS:

Claims 16-19 and 24 have been canceled.

Claim 1 has been rewritten as follows:

1. (Thrice Amended) A process for the preparation of polymers of ethylene comprising the polymerization reaction of ethylene and optionally one or more olefins in the presence of a catalyst comprising the product obtained by contacting:

(A) a metallocene compound of formula (I):



wherein

the rings containing A and B have a double bond in the allowed position having an aromatic character;

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A and B are selected from sulfur (S), oxygen (O) or CR⁹, R⁹ being hydrogen, a C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl, or C₇-C₂₀-arylalkyl radical, optionally containing heteroatoms belonging to groups 13 or 15-17 of the Periodic Table of the Elements, with the proviso that if A is S or O, B is CR⁹ or if B is S or O, A is CR⁹, and A and B cannot simultaneously be CR⁹;

R¹, R², R³, R⁴, R⁵, R⁶, R⁷, and R⁸ which may be the same as or different from each other, are hydrogen, a C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl, or C₇-C₂₀-arylalkyl radical, optionally containing heteroatoms belonging to groups 13 or 15-17 of the Periodic Table of the Elements, and at least two adjacent substituents R¹ and R², R³ and R⁴, or R⁵ and R⁶ can form a ring comprising 4 to 8 atoms, and where at least one of R¹, R², R³, R⁴, R⁷ and R⁸ is not hydrogen;

M is an atom of a transition metal selected from group 3, 4, 5, 6 or the lanthanide or actinide groups in the Periodic Table of the Elements,

X, which may be the same as or different from each other, is [hydrogen] hydrogen, halogen atom, a R¹⁰, OR¹⁰, OSO₂CF₃, OCOR¹⁰, SR¹⁰, NR¹⁰₂ or PR¹⁰₂ group, wherein the substituents R¹⁰ are hydrogen, a

A-2

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C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_2 - C_{20} -alkenyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl, or C_7 - C_{20} -arylalkyl radical, optionally containing heteroatoms belonging to groups 13 or 15-17 of the Periodic Table of the Elements;

p is an integer of from 1 to 3, being equal to the oxidation state of the metal M minus 2;

and

(B) at least one member selected from the group consisting of an alumoxane and a compound of formula D^+E^- , wherein D^+ is a Brønsted acid, [able to give a proton and to react] which gives a proton and reacts irreversibly with a substituent X of the metallocene of formula (I) and E^- is a compatible anion, which [is able to stabilize] stabilizes the active catalytic species originating from the reaction of the two compounds, and which is [sufficiently labile to be able to be] removed by an olefinic monomer.